DOI:10.1145/2993420

More accessible conferences, digital resources, and ACM SIGs will lead to greater participation by more people with disabilities.

BY JONATHAN LAZAR, ELIZABETH F. CHURCHILL, TOVI GROSSMAN, GERRIT VAN DER VEER, PHILIPPE PALANQUE, JOHN "SCOOTER" MORRIS, AND JENNIFER MANKOFF

Making the Field of Computing More Inclusive

APPLIED COMPUTER SCIENCE is concerned with the development of algorithms, applications, software, services, methods and measures, and hardware and devices. Excellent work continues to be done to make information technology accessible and usable for people with disabilities. For example, a number of familiar consumer technologies started out designed to provide access to people with disabilities, including the audiobook, speech recognition, captioning, and speech output (screen readers). Speech recognition enables hands-free computing, which is useful in situations like driving. Captioning of videos renders them available to text-based search algorithms but also makes video consumable when ambient sound levels are high, as in airports and gyms. Audiobooks, which began as a way for blind people to access reading material, are now everyday companions for travelers and commuters everywhere.[9]

In a 2012 *Communications* column, former ACM president Vinton G. Cerf highlighted the importance and difficulty of designing and developing accessible computing systems, making a public call for ideas and reports on success stories and experiences.[5]

Despite the long-term focus on making technology accessible for people with disabilities, the computing profession has not focused on making itself inclusive of people with disabilities; such people remain highly underrepresented at all levels and roles, including practitioner, researcher, student, and teacher.[4] Although the percentage of undergraduate students with disabilities in technology-related majors is fairly representative of the worldwide population as a whole, it is estimated that less than 1% of students who earned Ph.D.'s in computer science (as of 2011) identify as students with disabilities.[13] People with disabilities bring diverse perspectives to the design of technology. Like Cerf, the authors of this article believe becoming more inclusive will be of great benefit to ACM and to technology in general. It is thus important to examine the barriers that exist and determine, as a professional organization, how we can overcome them. This makes strategic and tactical sense; for a professional organization that wants to increase membership, there are many potential community members with disabilities

» key insights

- **People with disabilities are a potential source of ideas and additional membership for professional computing organizations.**
- **Including people with disabilities in the decision-making processes of professional computing organizations ensures the most important barriers are addressed first.**
- **Processes developed over years are needed to make physical conferences and their related digital content accessible to people with disabilities.**

DOOR IMAGE BY KUTLAYEV DMITRY, WITH CHI PHOTO BY CRYSTAL BUTLER. COURTESY OF CHI 2016 CONFERENCE

who could join the community were it more accessible.

So how do professional organizations in computing start to make themselves more accessible? What needs to be done to enable better access for researchers, practitioners, teachers, and students with disabilities? This article provides an overview of the process and a case study of the steps taken by SIGCHI, the ACM Special Interest Group on Computer-Human Interaction (http://www.sigchi.org/), to be more inclusive for people with disabilities. We note that the term "inclusive" can have a broader meaning that involves economic, geographic, and other types of diversity. In this article, we use the meaning of inclusion found in the fields of education and law, where being inclusive means providing equal opportunity for participation by people with disabilities.

Addressing Accessibility

SIGCHI is one of ACM's largest special interest groups, with approximately 3,500 members as of 2016. As with all SIGs, SIGCHI's core activities are to sponsor conferences, publish articles, and guide and support professional activities through mentoring and career development.

Over the past few years SIGCHI has sought to be more inclusive by decreasing barriers for participation encoun-

tered by people with disabilities. In collaboration with other SIGs (such as SIGACCESS, http://www.sigaccess.org/), our work has included indirect activities (such as educating conference leadership about disabilities and advocating for inclusion of people with disabilities on committees). We have also improved accessibility at conferences and to digital resources and provided professional-development activities.

We began by recognizing that career development, in all areas of computing, is greatly enhanced through several activities: attendance at conferences on a regular basis; production and consumption of digital resources, from blogs to multimedia content to articles in the ACM Digital Library; and involvement in sponsored mentorship programs. We identified three disability-related concerns that had to be addressed: organization and involvement of stakeholders; considerations regarding physical accessibility; and considerations regarding digital accessibility. Here, we address each in turn. Moreover, we have three corresponding goals in telling the SIGCHI story: underscore the importance of stakeholder engagement; offer broad suggestions for how large SIGs can improve inclusiveness of physical events and digital content; and underscore that addressing physical and digital accessibility is an ongoing process that takes time, with involvement by many stakeholders. The main message is that inclusiveness starts with the creation of an environment of continuous improvement in inclusiveness.

Before discussing them, however, we acknowledge that accessibility is a continuum and SIGCHI (or any other SIG) will not become a highly accessible and inclusive organization overnight.

Organization of stakeholders. It is important for the SIGCHI community to have an ongoing process for and platform through which people with disabilities can participate actively. SIGCHI thus created an advocacy group—the SIGCHI Accessibility Community—to work from within SIGCHI to develop best practices for ensuring improved accessibility. It has worked over the past several years on disability-related issues and produced a report[11] documenting accessibility concerns within the SIGCHI community. Jennifer Mankoff, one of the authors of this article, is chair of the SIGCHI Accessibility Community. The other authors are members of the community who have held leadership positions in the SIGCHI Executive Committee or in the conferences, in particular CHI 2014, where many of the practical initiatives were launched and trialed.

Physical accessibility. Many people with disabilities report that program committee meetings and conference facilities are often not accessible to people with motor impairments (such as those in wheelchairs). Moreover, elevators are sometimes not available, and few presentation stages have ramps. Processes should thus be planned in advance for requesting disability-related accommodations (such as sign-language interpretation for presentations and easy booking of accessible hotel rooms), and on-site accommodations need to be made available and communicated effectively in promotional materials or websites, as well as at event venues.

Digital accessibility. Many computing professionals use the resources available on the central ACM website (such as job banks, blogs, videos, and articles in the ACM Digital Library) that serve as the foundation for information sharing and knowledge growth. Within ACM, each SIG has its own website, with targeted digital resources for the needs of SIG members. Too often, however, the sites and information hosted are not in an accessible format, creating a discriminatory barrier. One approach has been to provide an "information on request" option for people unable to access certain content. But this is not an adequate solution; when digital resources are made accessible only upon request, the amount of material available to someone with a disability is limited and a time delay is introduced. This puts the person with a disability at a disadvantage compared to those without disabilities. Both the delay in time and the limitation in the amount of content available (due to "upon request" accommodations) can be considered forms of discrimination.[9] An informal analysis we conducted at SIGCHI revealed many conference websites, paper-submission processes, and conference-registration processes are not accessible.

SIGCHI as Case Study

SIGCHI has been addressing accessibility across the areas identified for improvement through a number of experimental initiatives. For example, an accessibility chair was first appointed at SIGCHI's flagship conference CHI as early as 1996 with some success, but the position did not continue consistently in subsequent conferences. A broader effort was needed, so, in 2011, the SIGCHI Executive Committee began a program to raise awareness and rationalize processes around inclusiveness; see the sidebar "SIGCHI Accessibility Timeline."

Education of leadership. The SIGCHI Executive Committee established a program of information gathering, reaching out to key professional groups and members of the SIGCHI community with disabilities, collaborating explicitly with two groups:

ACM SIGACCESS. ACM SIGACCESS is in many ways a role model, with accessible conferences and publications and a large percentage of community members with disabilities. SIGACCESS has documentation and processes for how to make conferences and digital resources accessible for all who want to participate. A core challenge in applying SIGACCESS approaches to the SIGCHI context is the difference in the attendee population. SIGCHI members are not all as aware or committed to accessibility as SIGACCESS members, whose expertise and interest center on accessibility. SIGACCESS also has a long-standing tradition of inclusion, so people with disabilities know their needs will be met at a SIGACCESS conference. SIGCHI needs to build this awareness among its membership, devise inclusive practices, and build a reputation for accessibility. To create awareness, enthusiasm, and engagement within a less-invested membership requires a different set of strategies.

AccessComputing. Staff of the AccessComputing project at the University of Washington have been key to SIGCHI's progress in accessibility. AccessComputing is a National Science Foundation-funded Broadening Participation Alliance that focuses on increasing access to the field of computer science for people with disabilities.[1] At the August 2013 SIGCHI Executive Committee meeting in Seattle, a subgroup

of the SIGCHI Executive Committee working on accessibility met with the AccessComputing leadership team.

Interaction with these groups made clear that a number of recommendations could be made. First, SIGCHI event organizers should be encouraged to appoint accessibility chairs or ensure that an advocate for accessibility would be part of the conference leadership committee. Second, discussions about stakeholder responsibilities should occur to, for example, clarify what aspects of accessibility are under the purview of ACM, vendors (such as website developers), and the conference committee. Such issues could perhaps be resolved or highlighted through appointment of accessibility chairs. Third, SIGCHI should recognize that reliance on volunteers represents a significant barrier to the scalability of accessibility throughout ACM and may be a major factor in limiting what leadership is able to accomplish.

As noted, SIGCHI leadership also discovered how advantageous it is to separate physical accessibility from digital accessibility. Although both are important, rarely in volunteer organizations like SIGCHI do the same people have responsibility for both for several reasons. First, the combination of expertise in physical and digital accessibility rarely resides in one person; for example, it is unlikely a single individual will have great experience in digital document markup languages for accessibility and the guidelines and recommendations for doorframe size and turnaround distance needed for wheelchair accessibility. Second, volunteer time is precious; it can be prohibitively time consuming for one person to take on all such responsibility. During the time period covered here, 2011–2016, within SIGCHI, the vice president (VP) of conferences and the general conference chairs for each sponsored and in-cooperation conference would have responsibility for physical accessibility. For digital accessibility, the VP of operations (for the website), the VP of publications (for the content being published), and the conference technical program chairs would have responsibility. The SIGCHI Executive Committee created a new structure—the CHI Steering Committee—in 2016 to oversee the activities of all conference committee chairs from CHI 2018 onward. One of the co-authors of this article, Jennifer Mankoff, was appointed to the steering committee to supervise implementation of a consistent level of accessibility throughout all SIGCHI-sponsored conferences.

SIGCHI Accessibility Timeline

The following is a timeline of SIGCHI's actions related to accessibility:

2011. Focused discussions on accessibility and inclusiveness begin at SIGCHI Executive Committee meetings.

2012. The SIGCHI Conference Management Committee begins using the SIGACCESS conference checklist at on-site facility walkthroughs; note it affected only locations that, at the time, were not yet contracted though is now in place for all future conferences.

2013. The Executive Committee creates a formal plan for inclusiveness at its spring meeting.

Email alias. **An email alias is created to invite SIGCHI members to share accessibility suggestions and provide a way for them to report problems;**

Inclusiveness. **The issue of inclusiveness is raised by the Executive Committee at the CHI 2013 Town Hall meeting in Paris;**

Questions. **Questions about accessibility and inclusiveness are added to the CHI 2013 post-conference survey and to all subsequent CHI post-conference surveys;**

Accessibility chairs. **The positions of "digital accessibility chair" and "physical accessibility chair" are added to the CHI 2014 committee;**

AccessComputing. **The Executive Committee meets with AccessComputing directors at the Executive Committee's summer meeting;**

Papers. **The webpage labeled "Information about making your CHI paper accessible" is added to the CHI 2014 conference website;**

Website and app. **Two experts evaluate the CHI 2014 website and related mobile app for accessibility;**

Accommodations. **Questions about disability-related accommodations are added to CHI 2014 registration forms and to all subsequent CHI registration forms;**

Automated reports. **All authors of accepted papers for CHI 2014 receive an automated report evaluating the accessibility of their submissions; and**

Accessibility Community. **The SIGCHI Accessibility Community is created.[10]**

2014. First face-to-face meeting of the SIGCHI Accessibility Community is held at the CHI 2014 conference in Toronto.

Chairs appointed. **Digital accessibility chairs and physical accessibility chairs are appointed to the CHI 2015 Technical Program Committee;**

Discussions. **Inclusiveness is discussed at the CHI 2014 Town Hall meeting in Toronto; and**

Officers elected. **For the first time, officers for the SIGCHI Accessibility Community are elected.**

2015. The first report examining SIGCHI accessibility is produced, documenting failures and successes of CHI (and SIGCHI-sponsored) conferences to meet the accessibility needs of attendees.

2016. The SIGCHI Executive Committee authorizes use of SIGCHI funds to create closed captions for all videos on the SIGCHI YouTube channel (https://www.youtube.com/user/acmsigchi).

Telepresence robots. **Individuals with disabilities unable to travel were encouraged to apply for the use of telepresence robots (deemed a success) at CHI 2016.**

Appointed. **Individual appointed to CHI Steering Committee to specifically work on accessibility.**

SIGCHI Accessibility Community

As more feedback and suggestions became available, it was necessary to prioritize requests in light of limited resources. Meeting in August 2013, the SIGCHI Executive Committee decided to crowdsource some of the feedback and priority setting. There is a mechanism on the SIGCHI website for the formation of SIGCHI "communities" in which members with a similar interest are able to use certain features on the website, including voting and resource sharing.[12] At the same meeting of the Executive Committee, several people who had been involved in the discussions about improving SIGCHI accessibility were invited to form a SIGCHI community on the topic of accessibility. Unlike SIGACCESS, the SIGCHI Accessibility Community's primary functions are to provide feedback to SIGCHI on accessibility efforts, help set priorities, and provide the op-

portunity for people with disabilities or those who are committed to improving accessibility to advance such efforts. The first face-to-face meeting of the SIGCHI Accessibility Community was held at the CHI 2014 conference in Toronto and its first officers were elected in November 2014. Today, it lists 53 official members on the SIGCHI website and 134 members in the Facebook interest group.

The mission of the SIGCHI Accessibility Community, as spelled out on the website, is to improve "... the accessibility of SIGCHI conferences, and the digital accessibility of SIGCHI web site and publications. Our priorities include providing clear support and information to conferences and their leadership about accessibility, providing support for SIGCHI members who are facing accessibility issues, advocating for accessibility issues, and liaising with other communities such as SIGACCESS." One of the first acts of the SIGCHI Accessibility Community in 2014 was to assess the state of accessibility across SIGCHI from a member perspective, conducting a survey of SIGCHI members and analyzing post-conference survey responses given by CHI attendees about CHI accessibility. Other data analyzed included the number of conferences in 2014 sponsored by SIGCHI with accessibility chairs (four of 17) and reports by community members on problems they had encountered. This led to the SIGCHI Accessibility Community's May 2016 report,[11] including five recommendations for future goals for SIGCHI:

Recommendation 1. Ensure 100% of conferences are accessible, have an accessibility policy, and have a clear chain of command for addressing accessibility issues;

Recommendation 2. Ensure 100% of new content (such as videos and papers) meets established standards for accessibility and develop a process for achieving this goal;

Recommendation 3. Create a process for handling accessibility requests within SIGCHI;

Recommendation 4. Increase representation of people with disabilities within SIGCHI; and

Recommendation 5. Assess SIGCHI's success in meeting accessibility guidelines at least once every two years.

The main message is that inclusiveness starts with the creation of an environment of continuous improvement in inclusiveness.

The SIGCHI Accessibility Community brought one major concern—accessibility of other SIGCHI-sponsored conferences—to the attention of the Executive Committee: Although the flagship CHI conference is steadily improving accessibility, most other SIGCHI-sponsored or in-cooperation conferences have taken no steps toward improving accessibility. The Accessibility Community has also highlighted key factors affecting accessibility that need to be addressed, including lack of a clear process (from the member perspective) for handling accessibility problems and constraints; the burden of negotiating accessibility on a case-by-case basis; the problems of depending entirely on volunteers to assess and improve accessibility; and the lack of accessibility at venues (such as in program committee meetings).

Physical accessibility. SIGCHI efforts related to physical accessibility have been evolving for several years. The SIGCHI Conference Management Committee first adopted the SIGACCESS conference physical-accessibility checklist for meeting and conference-site walkthroughs in 2012.[a] The first direct engagement with membership as a whole about physical accessibility was at the CHI 2013 conference in Paris, where SIGCHI leadership heard complaints about the venue's lack of physical accessibility. Discussion at the SIG Town Hall meeting at the conference led to adding a post-conference survey question regarding physical accessibility, resulting in 29 responses. Four issues were cited, the first two relating to hotel accommodations and the third and fourth to the convention venue itself:

Closest hotel. The closest recommended hotel was inaccessible for those using a wheelchair or scooter;

Connecting paths. Supposedly accessible connecting paths between the hotels and the convention center were poorly signed and not consistently open;

Ramps. At the convention center, presenters needing wheelchair or scooter access could not easily reach

a Because conference venues are contracted years in advance, walkthroughs in 2012 affected only conferences held in 2015 and later; for the checklists, including the "accessible conference guide," see http://www.sigaccess.org

stages, requiring portable ramps to be added; and

Distance. The vast size of the convention center meant considerable distance between events, affecting attendees with mobility limitations.

Based on the data collected, SIGCHI leadership concluded that two categories of data or communication were missing between organizers and attendees for the organization's conferences:

Attendees. Attendees, especially presenters, need a mechanism for letting conference planners know in advance if they require any type of special accommodations; and

Conferences. Conferences need to let potential attendees know in advance which meeting locations and hotel accommodations are accessible and which are not and provide specific directions (and, where appropriate, signage) to guide attendees along accessible routes between hotels and convention centers.

To address the first, a box was added to the subsequent conference registration form for CHI 2014, as well as for 2015 and 2016. The online forms invite authors of accepted papers/notes to indicate if the presenters of the papers/notes will need any type of disability-related accommodation and, if so, what type; for example, SIGCHI indicated it would fund as many sign-language interpreters as needed, but they must be requested in advance. To address information flow, a webpage was set up for the CHI 2014 conference website by the conference management team, the chairs, and the SIGCHI executive VP dedicated to physical accessibility, including detailed information regarding transportation and convention center and hotel contacts. The same information was provided for the CHI 2015 and CHI 2016 conferences. In addition, the committee in charge of venue selection began (as discussed in the sidebar's timeline) to assess site accessibility so a basic level of access can be ensured (such as wheelchairs and scooters being able to get to every part of the conference).

In 2014, SIGCHI leadership continued to ask about accessibility in the post-conference survey; while such survey data is not public, summaries of the data are included in reports from the SIGCHI Accessibility Community.[11] From the survey, 623 CHI 2014 attendees answered the question about accessibility, with only 12 indicating their expressed needs were not met and the rest that their needs were met. Only one of those 12 responses actually indicated a specific disability-related need that was requested but not met. The other responses indicated an accommodation that should have been requested but was not ("I had an accessibility-related special need but did not request an accommodation"); most of the comments related to the cost of the conference or labeling of food ingredients. Although these topics relate to the inclusiveness of the conference, none specifically related to perceptual, motor, or cognitive disabilities. In addition, one change has been made though not based on the feedback from surveys; several related conferences (such as ASSETS and ubiComp) allow telepresence robots (such as Beam from Suitable Technologies, Inc. of Palo Alto, CA) to allow for participation of individuals with disabilities who are unable to travel. The CHI 2016 conference committee accepted applications from members who wanted to participate in the conference via a Beam robot due to "mobility impairments, chronic health issues, or temporary travel limitations." The experiment with robots at CHI 2016 was deemed a success, with a total of 35 individuals participating via 10 telepresence robots.

Digital accessibility. For the CHI 2014 digital accessibility chair, three topical areas were suggested by the conference chairs for improvement: conference website, conference mobile apps, and papers-publication process.

Among them, the most challenging was the papers review process. There is one clear international technical standard for webpages—the Web Content Accessibility Guidelines (WCAG) version 2.0—that has been adopted by many national governments, educational organizations, and corporations.[14] The guidelines were used in May 2013 in two preliminary evaluations of accessibility—one by a SIGCHI Executive Committee member and one by the AccessComputing Project at the University of Washington—and changes were made to the website (minor tagging of images) to improve accessibility. This was a good starting point but not optimal because there should be more evaluations involving people with disabilities. A similar process was used for the CHI 2015 and the CHI 2016 conferences, and it is hoped the SIGCHI Accessibility Community can be involved in the future to perform user-based accessibility evaluations.

The technical program chair and digital accessibility chair for CHI 2014 learned that the papers-publishing company SIGCHI works with, Sheridan, offers the option of evaluating accepted-paper .pdf files for accessibility and notifying authors of violations. However, this option was not possible

CHI16 telepresence robots at recharging station.

PHOTO BY CRYSTAL BUTLER, COURTESY OF CHI 2016 CONFERENCE

for the CHI 2014 conference because the timeline and contract with the company had already been fixed. It will thus be investigated for future conferences for which contracts have not been set; the CHI 2015 contracts had already been signed, and the CHI 2016 committee decided not to take the option.

Many guides to .pdf accessibility assume much knowledge about .pdf design and provide a high level of detail about every possible violation. Unlike the WCAG 2.0 for webpages, there is no one clear, agreed-upon standard for .pdf documents. From all the various guidelines, from SIGACCESS and the various international standards bodies, the CHI 2014 papers review committee eventually adopted five recommendations for implementation for the CHI 2014 papers, in consultation with the AccessComputing group. The information was provided to authors on the conference website,[6] and the same guidelines were used for CHI 2015 and CHI 2016. The focus was on improving aspects of .pdf accessibility specifically related to CHI papers, including alternative text provided for images, table headers, generating a tagged .pdf, default language information in the .pdf, and having a correct tab order; readers are encouraged to visit the guide[6] for more on these recommendations. A detailed guide was created to provide step-by-step instructions for the five main recommendations. The goal was to maximize accessibility while minimizing the workload of individual authors.

Information on .pdf accessibility, including a step-by-step guide for adding accessibility information and tool information on checking a .pdf, was added to the CHI 2014 website, and information about .pdf accessibility was added to the CHI 2014 paper templates. This same information was used for CHI 2015 and CHI 2016.

The CHI 2014 conference received 2,043 submissions for papers and notes, with 465 accepted for publication. For all 465, the CHI 2014 team ran an automated check using Adobe Acrobat Action Wizard to create an accessibility report for each submission, creating a spreadsheet identifying which of the five recommendations each submission had addressed. The papers review committee sent a report to the primary authors on their submission's accessibility features, including links to the instructions for each of the recommendations. Authors received it before the camera-ready copy was to be submitted and were reminded to make their papers compliant with the five recommendations. The goal was to inform, educate, and improve digital accessibility. Making the .pdf file accessible was thus encouraged but not required. This action increased accessibility of accepted papers that were published in the ACM Digital Library but did not increase accessibility of the paper reviewing process. Furthermore, there are challenges with using some of the existing document production tools to create accessible .pdf files. Not all of the commonly used word processors and text editors support making accessible .pdf files; for example, MS-Word for Mac does not. In addition, although some previous attempts had sought to improve accessibility for LaTeX (such as Babett Schalitz's accessibility package[8]), those packages were not robust enough for general use for CHI 2014 and CHI 2015. Nevertheless, SIGCHI volunteers have continued to improve the group's LaTeX templates (such as LaTeX Accessibility[8]) and encourage participation by interested accessibility researchers and SIGCHI authors. In addition, SIGCHI maintains an up-to-date wiki page describing current best practice for creating accessible .pdf documents.[2]

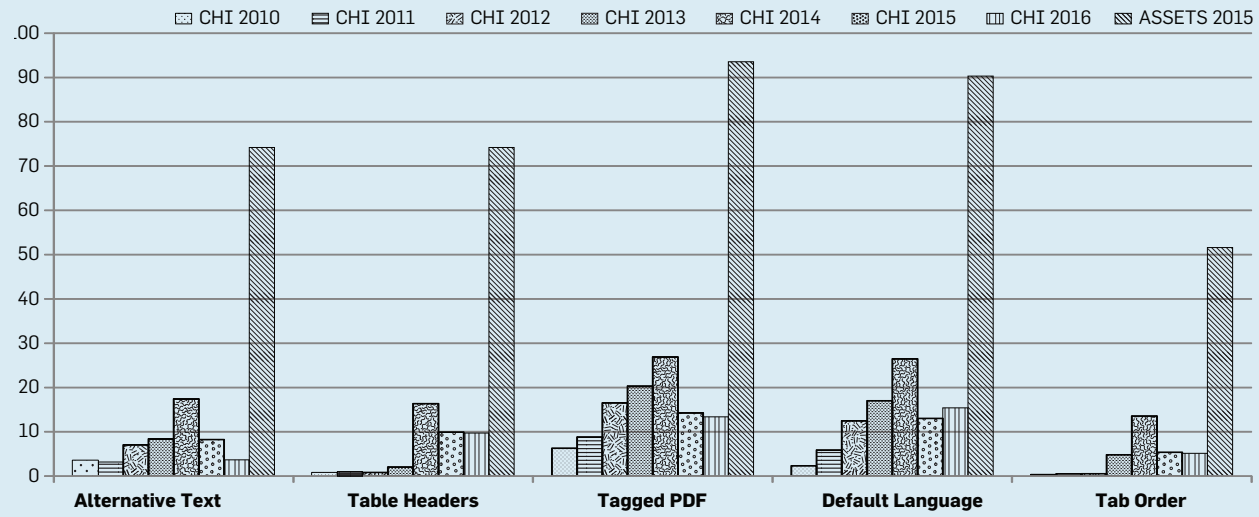
Unfortunately, the CHI 2015 and CHI 2016 conferences did not use the same approach as was used for CHI 2014 of providing specific feedback to authors on the accessibility of their papers. However, the CHI 2015 digital accessibility chair offered to have his research group (from Carnegie-Mellon University) make papers accessible for authors, with 25 authors requesting the service.[3] Although the service was not continued in 2016, the instructions on accessibility and the information in the paper template were still included. While the goal should be year-to-year consistency, having different approaches tested each year does give some useful data for future conference chairs.

Based on data collected by the CHI 2014 Conference Committee, accessibility of papers at CHI 2014 improved compared with previous years. Figure 1 shows the percentage of published CHI papers from 2010 to 2016 that included each of the five recommended accessibility features. The data in the figure indicates the accessibility reports sent to authors in 2014 helped encourage accessibility of papers. The accompanying table lists the same data from the figure in tabular form, showing compliance in four of five (not tab order) categories rose from 16% to 26%, much higher than in previous years. In every category of accessibility feature, the papers submitted were more accessible in 2014 than in any previous year of the CHI conference, though they were not 100% accessible, which is indeed the goal. A separate analysis confirmed that the accessibility of CHI papers improved in 2014.[3] However, without giving the authors individual notification of their papers' accessibility between acceptance and camera-ready submission in 2015, the accessibility levels of papers dropped between 2014 and 2015. Averaged over the five measures of accessibility, the accessibility of papers between 2014 and 2015 dropped nearly 50%. Figures were generally consistent between 2015 and 2016, except for the alternative text, which dropped by more than 50%, with 8.26% compliant in 2015 compared to 3.67% compliant in 2016.

Percentage of published papers that adhered to each of the five recommendations (%), 2010–2016.

	Published CHI Papers (% following the guidelines)						
	CHI 2010	CHI 2011	CHI 2012	CHI 2013	CHI 2014	CHI 2015	CHI 2016
Alternative Text	3.6	3.2	7.0	8.4	17.4	8.3	3.7
Table Headers	0.7	1.0	0.8	2.0	16.3	9.9	9.7
Tagged PDF	6.3	8.8	16.5	20.3	26.9	14.3	13.4
Default Language	2.3	5.9	12.5	17.0	26.5	13.0	15.4
Tab Order	0.3	0.5	0.5	4.8	13.5	5.4	5.1

Figure 1. Percentage of published papers that adhered to each of the five recommendations (%), 2010–2016. The bars here and in Figure 2 are covered in patterned fill, rather than colors, to make the graphs more inclusive for colorblind readers.



Giving authors individual notification of their papers' accessibility between acceptance and camera-ready submission in 2014 clearly increased the level of accessibility compliance. While accessibility of papers did increase, 16% to 26% is still not ideal, with a long way to go. As a comparison, we analyzed the accessibility of published papers from the ASSETS 2015 conference, though the sample size for ASSETS papers was 31, much smaller than the number of CHI papers in any given year. ASSETS generally uses two different approaches that have not yet been attempted by the CHI conference: The first is that authors are required (not just encouraged) to make their papers accessible and the second that SIGACCESS, sponsor of the ASSETS conference, specifically requires the company that is contracted for publishing, Sheridan, to manage the accessibility process and check for accessibility. We do not know the specifics of what is required in its contracts with Sheridan, and it is possible Sheridan is required to check for different accessibility features than in our evaluation. Given identical criteria, compliance for ASSETS 2015 papers was much higher than for CHI papers (in any given year) but still not at the 100% goal. In 2015, 74.1% of the ASSETS papers had alternative text and table headers, 93.5% had generated a tagged .pdf file, and 90.3% had default-language information included in the .pdf, but only 51.6% of ASSETS 2015 papers had a correct tab order.

Figure 2. Difference in adherence among the 465 accepted papers for CHI 2014 between submitted and final versions (%). The bars here are likewise covered in patterned fill, rather than colors, to make the graphs more inclusive for colorblind readers.

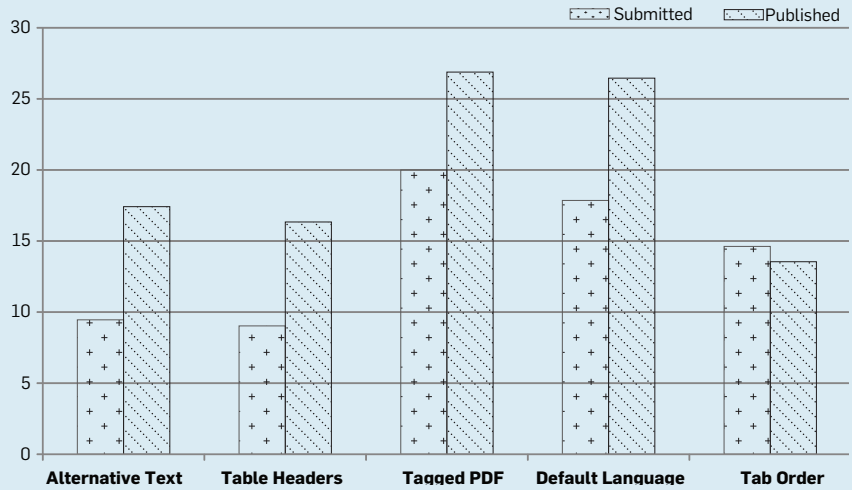


Figure 2 shows the difference in adherence between initial and final submissions for the 465 papers accepted for publication at CHI 2014, where authors were given specific details on the accessibility barriers of their respective papers. In four of five recommendations, accessibility of the papers increased 5% to 10% based on authors receiving feedback on accessibility. Unclear is why adherence to one recommendation (tab order) decreased slightly. There may be cases where authors had to update their final submission based on feedback from the publication vendor and forgot to reapply the accessibility changes.

Note that 30% accessibility of published papers or even 60% accessibility is not ideal. The goal, as spelled out by the SIGCHI Accessibility Community, is 100% compliance. However, accessibility is a multi-pronged effort, and paper accessibility gets attention because it is an easy-to-measure metric; equally important are many other details we have discussed here (such as having accessibility chairs at each conference, proper information flows, and accessible physical locations). For instance, in choosing the site for the CHI 2019 conference—Glasgow, U.K.—accessibility criteria were specifically taken from the city's proposals, as well as from on-site walkthroughs, which led to one city with a fully accessible conference venue being chosen

over another equally attractive city but with a conference venue with multiple accessibility barriers.

In addition to event-specific efforts (such as those described here), other efforts to improve accessibility have been ongoing on multiple fronts within SIGCHI over the past few years. For instance, a SIGCHI email alias—sigchi-accessibility@listserv.acm.org—was set up for members to share their concerns with the Executive Committee, underscoring SIGCHI's commitment to being open and welcoming to academics, researchers, and practitioners with disabilities by inviting comments and concerns related to the organization's websites, publications, or physical accessibility at any SIGCHI-sponsored events, including conferences.

Another example of progress involves video captioning. SIGCHI captures the video and slides of a selection of the presentations at CHI and other SIGCHI-sponsored conferences. These presentations are included with the .pdf of the papers in the ACM Digital Library. Starting in 2016, SIGCHI volunteers began to work with ACM to create an ACM SIGCHI YouTube channel to host much of this content. As part of the effort, the SIGCHI Executive Committee authorized use of SIGCHI funds to create closed captions for all the videos on its YouTube channel. Once a video is uploaded to YouTube, SIGCHI works with a captioning company to develop professional (not automated) captioning. Because the captions are human generated, the time to caption all the videos in a conference can vary depending on the total number of videos uploaded.

Suggestions for All Computing Organizations

SIGCHI members surveyed as part of the SIGCHI Accessibility Community Report[11] were typically not aware of any SIG or ACM policy or procedure regarding inclusiveness for people with disabilities. This was the case for those with and those without disabilities. For example, respondents reported[11] being unable to answer the following questions: How can someone with a disability participate in a mentorship program sponsored by the organization? What happens when someone who is blind wants to vote in an election or run for office? Are the online tools utilized by journal editorial boards accessible? Do the procurement processes for these large contracts include accessibility? And what policies are used for remote participation?

Based on the SIGCHI experience, we can say that professional organization inclusiveness begins with explicit discussions on inclusiveness, and awareness and discussion represent an important first step. Executive committees of SIGs should start the discussion, which should expand to include conference chairs. Conference chairs should discuss accessibility with their technical program chairs. Executive committees should contact members of the professional community with known disabilities and email distribution messages asking for input and feedback. Conference chairs should also be aware that some disabilities are "invisible disabilities" that might not be apparent (such as learning disabilities and disabilities affecting energy level, as with Lupus and Lyme Disease). Starting the discussion produces information sharing, which should lead to a more formalized structure like a policy or specific committee position (such as accessibility chair for a conference). None of these changes will happen overnight. Becoming more inclusive is a process that takes place over a period of years. We thus recommend the following six actions for all ACM SIGs:

Reach out to SIGACCESS. No one within ACM has more experience with accessibility issues than SIGACCESS. At various points, SIGCHI used the SIGACCESS conference accessibility guidelines and portions of the SIGACCESS document accessibility guidelines and consulted with various members of the SIGACCESS Executive Committee who were always happy to help. It may be the SIGACCESS solutions cannot be implemented directly by another SIG due to scalability or lack of expertise, but SIGACCESS has the experience of creating solutions for most accessibility issues. SIGACCESS officers welcome inquiries and contacts from other SIGs.

Encourage proactive involvement and foster bidirectional communication. Make it easy for community members to notify the organization of potential accessibility needs before events like conferences, thus allowing appropriate accommodations to be made; if such accommodations are not possible, individuals can be warned. SIG and conference organizers must be clear and up front about accessibility at a conference, answering: What, from a physical point of view, is accessible, and what is not? What barriers will attendees face? And is there a hotel that may be farther away but that involves fewer barriers? Encourage feedback from the community at events and between events.

Include people with disabilities in organizational processes. One of the mottos of the disability rights movement is "nothing for us without us." Decisions about accessibility need to be made based on feedback from those with the most experience—people with disabilities. It is important early on to identify members of your community with disabilities who can provide specific feedback. Acknowledge that perspectives may be skewed; if your community includes many people with one type of disability, the feedback you receive may be biased. A core advisory group can provide feedback and advice and can help determine priorities.

Be clear about your priorities and communicate rationales. It is important to acknowledge that everything cannot be done at once. For instance, for an organization starting to become more inclusive, which of the following is a better first step: Making papers accessible or making videos on the website accessible? Making mentorship programs more inclusive or making journal editorial board software more accessible? Making the conference facility selections more accessible or setting up programs for remote attendance? All are important goals that should be achieved over time, but all cannot be achieved immediately. A dedicated advisory group, as with SIGCHI's Accessibility Community, can be useful in setting priorities. Once priorities are set, they need to be communicated to the membership and to the broader community.

Recognize and explicitly address and communicate trade-offs. Be open about the fact that there are often trade-offs, as in the one between internationalization and consistent models of accessibility. Part of being an international organization means holding confer-

ences all over the world, including locations that have different accessibility requirements and accommodations. Such trade-offs should be acknowledged. When practices differ, it is critical that they be explicitly documented and communicated.

Allocate budget from SIG funds. Allocate budget from your SIG funds to support professional services (such as video captioning). Be clear about what work is done by volunteers and what is outsourced to professional services. SIGCHI and ACM function primarily through their volunteers, but SIGCHI has decided some aspects of accessibility are so important that we must contract with professionals who can provide dedicated and reliable focus to drive our inclusiveness agenda forward. This is not a criticism of the volunteers; all are committed to these initiatives, but for many, such plans are not their primary work focus, so a reliable, accountable effort is not a reasonable expectation.

Conclusion

We have three goals in telling the SIGCHI story: underscore the importance of stakeholder engagement; offer broad suggestions for how large SIGs can improve the inclusiveness of physical events and digital content; and underscore that addressing physical and digital accessibility is an ongoing process that takes time, with involvement of many stakeholders. These stakeholders must work together to drive the creation of acceptable and accepted guidelines and resources, find individuals with expertise to work in an advisory capacity, and find volunteers to implement effective strategies and provide feedback regarding the policies and guidelines in action.

Improving the inclusiveness of any organization is a long-term process. It involves planning, structure, and information sharing. It involves checklists and inspections. It involves a commitment to programmatically raising awareness through communication and action. But where does inclusiveness start? One possibility is with members of the specific community raising awareness about barriers. But we advocate a more proactive stance. A professional community that has not been inclusive of people with disabilities is not likely to have members with disabilities who will raise awareness of what is needed. Inclusiveness must start with proactive outreach to increase inclusiveness so change can be driven from within the organization. A reactive stance through which accessibility issues are dealt with as (and only if) they occur is not programmatic and will not be as effective.

The impact of greater accessibility can be profound. The more accessible an organization becomes, the more people will feel comfortable giving feedback and working actively toward inclusive solutions that can lead to more members. As Kirkham[7] said about the current situation, "In practice significantly more research is being done about people with disabilities than by people with disabilities within SIGCHI." SIGCHI's hope is that SIGCHI will be a community that is perceived as welcoming for all researchers and practitioners with disabilities.

In addition, actions on the part of any organization, including a SIG community, have the ability to influence outside actors. Large SIGs, when they educate others about digital and physical accessibility, can have significant influence on the conference locations they rent and the universities and companies that employ their members.

ACM has a leading role to play by ensuring all SIGs strive to be inclusive and by thus being a role model for other professional associations. The best way to handle such responsibility would ultimately be to ensure there are professional staff supporting and centralizing the most vital accessibility needs and accessibility is included in contractual relationships (such as with organizations that produce ACM's website and publications and contract conference venues).

Acknowledgments

The authors would like to acknowledge the advice provided by Sheryl Burgsthaler, Richard Ladner, Clayton Lewis, Jennifer Rode, Terry Thompson, Shari Trewin, and Jeff Bigham to the SIGCHI Executive Committee and CHI 2014 and CHI 2015 Program Committees.

References

1. AccessComputing: The Alliance for Access to Computing Careers; http://www.washington.edu/accesscomputing/
2. Accessibility; https://github.com/sigchi/Document-Formats/wiki/Accessibility
3. Brady, E., Zhong, Y., and Bigham, J. Creating accessible PDFs for conference proceedings. In *Proceedings of the 12th Web for All Conference* (Florence, Italy, May 18–22). ACM Press, New York, 2015), article 34.
4. Burgstahler, S., Ladner, R., and Bellman, S. Strategies for increasing the participation in computing of students with disabilities. *ACM Inroads 3*, 4 (2012), 42–48.
5. Cerf, V. Why is accessibility so hard? *Commun. ACM 55*, 11 (Nov. 2012), 7.
6. CHI 2014 Program Committee. CHI 2014 Guide to an Accessible Submission; http://chi2014.acm.org/authors/guide-to-an-accessible-submission
7. Kirkham, R., Vines, J., and Olivier, P. Being reasonable: A manifesto for improving the inclusion of disabled people in SIGCHI conferences. In *Extended Abstracts of the 33rd Annual ACM Conference on Human Factors in Computing Systems* (Seoul, Republic of Korea, Apr. 18–23). ACM Press, New York, 2015, 601–612.
8. LaTeX Accessibility; https://github.com/sigchi/Document-Formats/issues/1
9. Lazar, J., Goldstein, D., and Taylor, A. *Ensuring Digital Accessibility Through Policy and Process.* Elsevier/Morgan Kaufmann Publishers, Amsterdam, the Netherlands, 2015.
10. SIGCHI Accessibility Community; http://www.sigchi.org/communities/access
11. SIGCHI Accessibility Report; https://docs.google.com/document/d/1XBUV9klS5D430wZJf70d4EvQWR7AIfJ7nQQ3zX26bjw/edit?pref=2&pli=1#heading=h.w0fjbae5fw42
12. SIGCHI Communities; http://www.sigchi.org/communities
13. Taylor, V. and Ladner, R. Data trends on minorities and people with disabilities in computing. *Commun. ACM 54*, 12 (Dec. 2011), 34–37.
14. World Wide Web Consortium (Web Accessibility Initiative). *Web Content Accessibility Guidelines 2.0*; https://www.w3.org/TR/WCAG20/

Jonathan Lazar (jlazar@towson.edu) is a professor of computer and information sciences and director of the Undergraduate Program in Information Systems at Towson University, Towson, MD, and recipient of the SIGCHI 2016 Social Impact Award.

Elizabeth Churchill (churchill@acm.org) is a director of user experience at Google, San Francisco, CA, and Secretary/Treasurer of ACM.

Tovi Grossman (tovi.grossman@autodesk.com) is a distinguished research scientist in the User Interface Research Group at Autodesk Research, Toronto, Canada.

Gerrit C. van der Veer (gerrit@acm.org) is an emeritus professor of multimedia and culture at the Vrije Universiteit Amsterdam, the Netherlands, guest professor of human-media interaction at Twente University, Twente, the Netherlands, of human-computer and society at the Dutch Open University, Heerlen, Netherlands, of interaction design at the Dalian Maritime University, Dalian, China, and of animation and multimedia at the Lushun Academy of Fine Arts, Shenyang, China.

Philippe Palanque (palanque@irit.fr) is a professor of computer science at Université Paul Sabatier Paul Sabatier – Toulouse III, France, and head of the Interactive Critical Systems research group of the IRIT laboratory, Toulouse, France.

John "Scooter" Morris (scooter@cgl.ucsf.edu) is an adjunct professor in the Department of Pharmaceutical Chemistry at the University of California San Francisco and executive director of the Resource for Biocomputing, Visualization and Informatics, a U.S. National Institutes of Health Biomedical Technology Research Resource at the University of California San Francisco.

Jennifer Mankoff (mankoff@cs.cmu.edu) is a professor in the Human Computer Interaction Institute at Carnegie Mellon University, Pittsburgh, PA.